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02.08.1; 03.13.4; 02.19.1; 02.07.1; Time-Independent Gravitational Fields in the BGK Scheme for Hydrodynamics

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abstract We incorporate a time-independent gravitational field into the BGK scheme for numerical hydrodynamics. In the BGK scheme the gas evolves via an approximation to the collisional Boltzmann equation, namely the Bhatnagar-Gross-Krook (BGK) equation. Time-dependent hydrodynamical fluxes are computed from local solutions of the BGK equation. By accounting for particle collisions, the fundamental mechanism for generating dissipation in gas flow, a scheme based on the BGK equation gives solutions to the Navier-Stokes equations: the fluxes carry both advective and dissipative terms. We perform numerical experiments in both 1D Cartesian geometries and axisymmetric cylindrical coordinates. hydrodynamics—methods:numerical—shock waves—gravitation